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METASEDIMENTS OF THE DEEP CRUSTAL SECTION OF SOUTHERN KARNATAKA.

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The deep continental crust all the world over includes within it a close association of charnockitic granulites and metasediments. Noting the constant association of the two in the deep crustal charnockite region of southern peninsular India, Naidu (1) remarked "A 'charnockite province'........ is mainly psychological. It can as well be a 'khondalitic' or 'calc-silicate' province."

The southern Karnataka region discussed here (longitude 77° 7' - 77° 15' E and latitude 12° 13' - 12° 40' N) constitutes the northern fringes of the charnockite region. While the northern part of over 1300 sq.km. is composed essentially of amphibolite facies gneisses and granites, the southern about 600 sq.km. exposes granulites and transition granulite amphibolite facies rocks. The metasediments occur all over the area as small isolated enclaves and as conformable bands, lenses, pods and patches. Both metasediments and the associated charnockites and the amphibolite facies gneisses are tightly (and repeatedly) folded/deformed together. The correct stratigraphic sequence among the different metasedimentary units is not revealed by the recorded pattern of their distribution. Neither is the age relation between the metasediments and the charnockites inferrable. Quite strikingly whether enclosed within the granulite or the amphibolite facies rocks, the metasediments display about the same degree of granulite facies metamorphism and there is not much of later retrograde metamorphic impress.

The metasediments of the area could be broadly divided as siliceous, aluminous, Fe-Mn and impure calcareous types. The siliceous sediments vary from pure ortho-quartzites to those corresponding to shaly (and ferruginous) sandstones containing small proportions of sillimanite, cordierite, feldspars, mica, pyroxenes and garnet which tend to be concentrated in occasion thin laminae. The aluminous sediments vary from garnetiferous (+ pyroxenes) quartzofeldspathic rocks (i.e., corresponding to leptynites) and sillimanite quartzites to those containing a large proportion of cordierite (with consistently positive optic sign), sillimanite, almandine garnet (with 25 to 35% pyr) and biotite, and commonly including within them thin bands, patches and lenses of cordierite-orthopyroxene (with 3.5 to 4.5% Al_2O_3)-biotite and quartz-orthopyroxene-clinopyroxene-garnet (63% Alm 15% Pyr, 15% grs)-plagioclase (72-78% An) (+ hornblende) bearing units (Devaraju and Sadashivaiah) (2,3). The Fe-Mn sediments include banded Mn-poor (av 0.63% MnO) and manganiferous (av 7.6% MnO) iron-formations which occur completely mixed together and very commonly contain Fe-Mn pyroxenes (Opx with less than 0.4 to 15% MnO, Cpx with 0.1 to 7.5% MnO) and garnets (81.6 to 28% Alm and 3.6 to 49.6% spes) as major mineral phases (Devaraju and Laajoki) (4). The impure carbonate units typically occur as small isolated bodies usually containing ferrosalite (~55% He), Quartz, bytownite (72-78% An), grossularite (~67% gros), scapolite (~84% Me), carbonate and sphene (Devaraju and Sadashivaiah)(5). The mineral assemblages and mineral compositions of metasediments are distinctly different from those of the charnockitic granulites (while all the metasediments very commonly and typically contain garnet, the charnockites and also the amphibolite facies gneisses are generally devoid of garnet) and no significant mineralogical gradations are recorded between the two (exceptions are perhaps the noritic assemblages occuring at the contacts of pelitic units). The mineral assemblages of metasediments whether enclosed in charnockites or in gneisses are in textural/chemical equilibrium.

Both interms of major as well as trace element geochemistry, as distinct from charnockites and amphibolite facies gneisses, which are just about the same as calc-alkaline igneous rocks, the metasediments closely compare with those of common sedimentary rocks. Apparently, despite high-grade (and repeated) metamorphism, there was no significant migration of chemical constituents across the primary banding/lamination/stratification to obliterate the original sedimentary structures and the metamorphic reactions were remarkedly confined to the component units of individual sedimentary bands.

On the whole the sediments of the deep crust of Karnataka include clastic dominated siliceous to pelitic units, deposited in relatively shallow waters, and mixed clastic, volcanogenic to chemogenic impure calcareous to Fe-Mn units deposited in relatively deep waters. The manganiferous iron formations in particular, with a distinctly high average total of 15% Al_2O_3 + MgO + CaO, seem to represent an admixture of (volcano) clastic and chemical sediments. Like sediments in the Sargur sequence (Janardhan et al) (6) these also appear to have deposited in essentially shallow basins at the continental margins.

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Metamorphic temperature of 609° to 935°C (mean 673°C) and pressure of 6.5 to 10.7 kbar (mean 8.6 kbar) have been obtained for the metasediments according to the methods of Wood and Banno (7), Raheim and Green (8), Wells (9), Thompson (10), Ellis and Green (11), Ganguly (12), Kretz (13), Harley (14), Sen and Bhattacharya (15), Wood (16) and Ghent (17), Perkin and Newton (18). These data are similar to those obtained for the associated charnockites and are consistent with the observation that the two groups of granulite facies rocks are coeval and have had much the same metamorphic history (Devaraju and Sadashivaiah) (19). The geobarometric data obtained further suggests that the deep continental section exposed in southern Karnataka was at depths of about 30 kms at the time of granulite facies metamorphism.

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